JOURNAL

American Society of Tool Engineers

MARCH, 1934

Secretary
MAdison 2057

Editor
MAdison 8422

A. S. T. E. Journal

Published by the American Society of Tool Engineers
8316 Woodward Avenue
Detroit, Michigan

Published for Members Only

VOL. II MARCH No. 11

O. B. JONES, Editor

Address all editorial matter, advertisements, and inquiries to A.S.T.E. Journal, 8203 Woodward Avenue, Madison 8422.

Rigidmil Sets Fast Pace On Clutch Pressure-Plates

"What's your proposal for milling grooves in three lugs on cast-iron clutch pressure-plates, at the rate of 100 plates an hour or better?" This question was put to the Sundstrand Engineered Production Department recently. The plates are shown in Fig. 1. The Sundstrand answer to the question is shown in Fig. 2. It is a No. 4 Rigidmil with 3-spindle head and indexing base carrying six fixtures. Excepting the spindle-head and its outboard support, this Rigidmil is standard throughout including the indexing base. This arrangement produces a completely milled plate at each reciprocation of the table, and permits the operator to change work pieces while cuts are in progress. The fixtures take two sizes of pressure-plates, the three Rigidmil spindles are individually adjustable to accommodate the different sizes and to compensate for cutter wear. The machine went on production work the same day it was installed in customer's plant. Output for the first full day's run averaged 137 plates an hour. This compares very favorably with the production of a special machine, with automatic fixtures, several times as big as the Rigidmil and costing much more.

For high production at low cost, for maximum return on your money invested in milling machines—or lathes—consult Sundstrand. Reliable estimates submitted promptly on receipt of complete data.

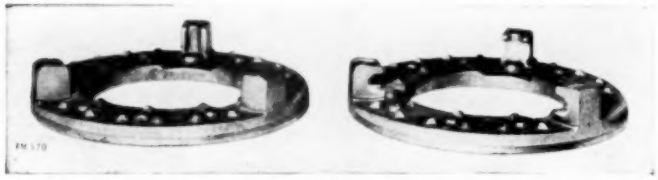
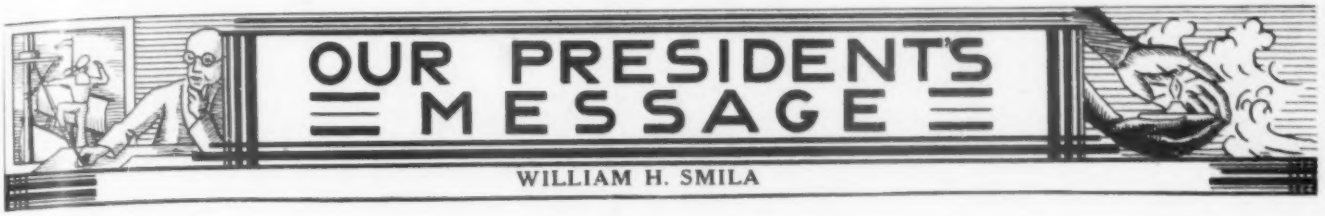


Fig. 1. Clutch pressure-plates before Rigidmiling, at left; afterwards, at right.

Fig. 2. Rigidmil with 3-spindle vertical head, indexing base, and fixtures for milling grooves in three lugs on cast-iron clutch pressure-plates.



A. S. T. E. MEETINGS

Our meetings committee prepared an excellent program for the meeting which was held February 8th, in the General Motors Building. This was a joint meeting of the American Society of Tool Engineers and the Detroit Chapter of the Society of Industrial Engineers. We expected a very large turnout from both societies, but due to the extreme coldness of the weather the attendance was much smaller than anticipated. The principal speaker of the evening was Mr. Robert W. Ackley. Mr. Ackley is a member of the Society of Industrial Engineers and his talk on the Industrial Mobilization Plans of the U. S. Army Air Corps was very well presented and shows that the government is not "asleep at the switch" in formulating plans and organizing the manufacturing facilities of the country for munitions production in case of war. I am sure the entire membership would have profited by Mr. Ackley's talk and am sorry more members did not hear him. Mr. Samuel Hudd, President of the Detroit Chapter of the Society of Industrial Engineers was also present and introduced some of the officers and members of his society to our members.

It was also decided at this meeting to elect the same nominating committee that was elected a year ago. Upon these gentlement, will fall the duty of selecting candidates for the various offices of the Society. There are many capable men in our organization that would undoubtedly be willing to serve as officers of the society and it is up to the nominating committee to "discover" them. It is an unwritten law that no officer except the Secretary hold his office for more than one term, although the officers may be elected to other offices of the Society. I believe this to be a good "law" as it prevents monopoly, and gives every member a chance to serve the Society.

The new meeting place is ideal for holding our meetings, being more centrally located than the Detroit-Leland Hotel. I understand Mr. C. E. Johansson of "gage block" fame is to be the speaker at the March meeting and it is hoped we will have a large turnout at this meeting. A dinner will be served at the next meeting and every member should plan to attend. If you are unable to attend the dinner, arrange to attend the meeting, thereby showing the meetings committee that you appreciate heir efforts. This will be the last meeting conducted by the present officers so let's all get together and make it one of the largest meetings of the year.

FEBRUARY MEETING

THE February meeting of the American Society of Tool Engineers was held at The General Motors Building February eighth at 8 o'clock P.M. and in spite of the sub zero weather had a fair attendance. It is apparent that the members are enjoying these meetings and are deriving something of value from them when they attend on a night like that. Many choice words were heard when it came time to start their cars to go home after the meeting.

This was our first meeting in the General Motors Building which is a splendid place for such meetings.

The February meeting was held in conjunction with the Society of Industrial Engineers.

A Nominating Committee was elected to nominate candidates for the offices of the American Society of Tool Engineers for the coming year. After the business portion of the meeting was over we were priviledged to listen to Mr. Robert W. Ackley, Procurement Planning Assistant U. S. Army Air Corps, who gave us a very interesting talk and ran five films depicting the development of transportation, the general work of the Material Division, Air Corps and Army Equipment, parachutes and similar items, and a comedy. The meeting adjourned at 10:45 o'clock.

INDUSTRIAL MOBILIZATION PLANS OF THE U. S. ARMY AIR CORPS

by ROBERT W. ACKLEY

Procurement Planning Assistant, U. S. Army Air Corps

"THE matter of industrial modilization is a large one. I can't pretend to cover all of it and during the course of the evening I am going to try and deal with my own experience and what I have learned and what we are attempting to do in the district offices, in particular, how we work with the different manufacturers. Just as a brief outline, I am first going to explain what mobilization is; then what industrial mobilization is; the various steps in the procurement planning and particularly how the different district officers work in carrying out the steps of procurement planning.

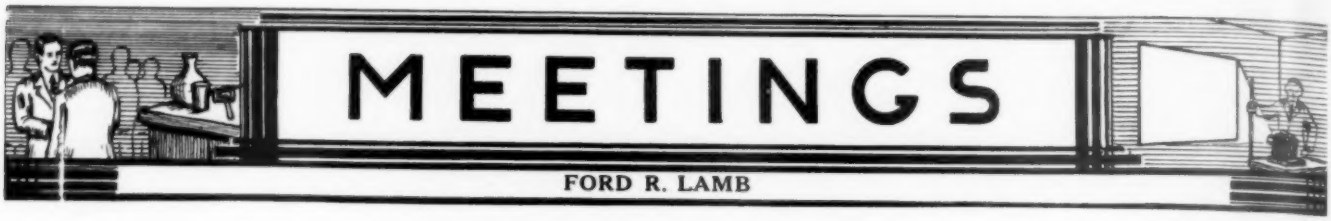
"This country has no desire to have another war. War is a futile thing and the winner is always the loser, too. But, with the present set-up of the world and the population of the world, we cannot conceive that just because we do not want war we will never have a war. If we may have another war, the question then is "What and how are we planning to take care of the furnishing of equipment.'

"The subject of industrial mobilization is a large one. There are the various set-ups and plans being developed in Washington. The matter of price-control, strategic materials, and a number of other factors. Those I am not going to dwell on; I am going to try and cover the matter of what the different manufacturing plants will be called upon to produce and how they will function; what plans are now being made and how we are making those plans. The matter of supply of an army is a very important one. You all remember that Napoleon said that an army marches on its stomach. Since his day there have been tremendous items in equipment that have rendered the problem of supply strictly important.

"This country does not carry adequate reserves for the large mobilization that might sometime be needed. The reason is the frequent changes in the items, the expense and the deterioration of those items. In 1920 the National Defense Act was passed and one particular section charged the Assistant Secretary of War with the responsibility for the adequate resources and the procurement of these materials. In a few phrases, they settled the subject then and there, but as time has passed, under his jurisdiction he has found that this has been a tremendous problem and so while he is responsible for obtaining these adequate resources, the actual preparation and the plans and determination of articles, and so on have been made a function of the different supply armies and services. Their problem is to determine their equipment and make the plans for their respective items.

(To be continued next issue)

"See page 6 for important next meeting announcement."



MARCH MEETING

Thursday, March 8

GENERAL MOTORS BUILDING

Dinner: 6:30, in Cafeteria (Obtain tickets at the door—$1.00. Call Madison 2057 for reservations)

Technical Session: Same Place

PRECISION MEASUREMENTS

By

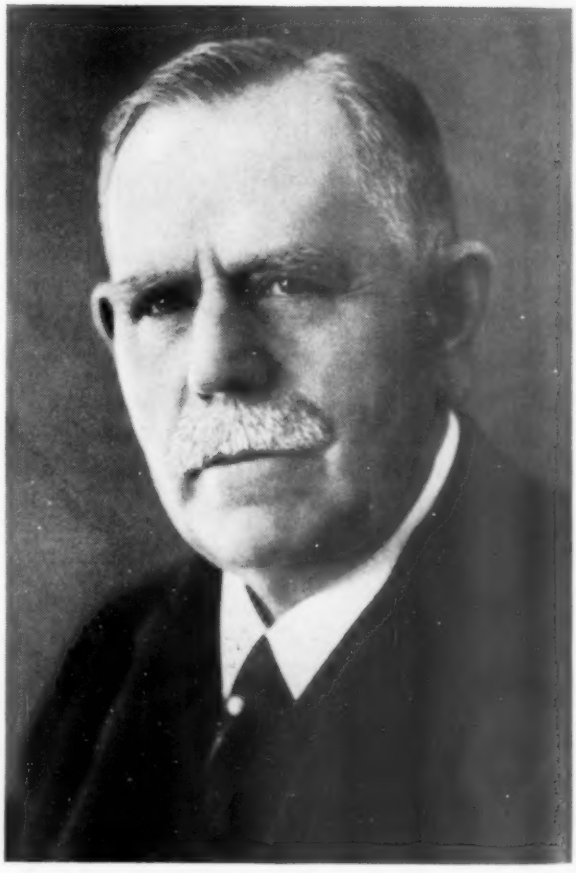
C. E. JOHANSSON

CARL EDWARD JOHANSSON was born the 15th of March, 1864, in Frotuna, Province of Westmanland, Sweden. He obtained his early technical training at the Gustavus Adolphus College, St. Peter, Minnesota. He has for many years been world-famous as the inventor of "the world's standard of measurement." He invented and perfected a set of 81 gage blocks from which 120,000 different sized gage combinations can be built in consecutive steps of one ten thousandth of an inch.

Here is a man who, like Bell, Franklin, Fulton and Westinghouse was ridiculed by the supposedly brainest men of his day when he made the assertion that he could guarantee the accuracy of a dimension to within one hundred thousandth of an inch. It didn't seem possible that any human being could guarantee any dimension to be within a tolerance of one two-hundreth of the thickness of a two-thousandth diameter hair plucked from the human head.

Following is an excerpt from Volume 31 of the 12th Edition of the Encyclopedia Britannica:

"The decade 1910-20 saw a noteworthy development in every branch of machine-tool engineering. In no branch was the progress more marked than in instruments for precise measurements. These include types employing both physical and optical means. Their perfection has made possible the production of interchangeable parts in commercial quantities. Without means of accurate gauging the making of cheap automobiles in great numbers would be impossible. This is also true of rifles, typewriters, sewing machines and hundreds of other things made and used daily in great numbers. For accuracy and almost universal application, the gauge blocks made by C. E. Johansson, Eskilstuna, Sweden, stand high. The first combination set on his system was made in 1897, but not until 1911 was Johansson able to produce them in commercial quantities of a guaranteed quality. Subsequently these blocks became so recognized as standard that there is hardly a manufacturing plant in the world doing accurate or interchangeable metal work that has not one or more sets for reference purposes or actual use. They are also in constant use at the *National Physical Laboratory, London;* the *National Bureau of Standards, Washington;* the *Bureau International des Poids et Mesures, Paris,* and similar institutions of all the principal nations."

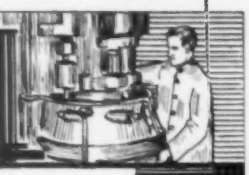


C. E. JOHANSSON

Everybody welcome! Come and bring your friends!

"See page 6 for important next meeting announcement."

NEW MACHINES



HAROLD GILLER B. L. DIAMOND

THE HEALD No. 81 INTERNAL CENTERLESS

THE principles of centerless grinding which have been so successfully used for external grinding have now been employed for internal grinding.

The principles of external centerless grinding consist primarily of passing a workpiece between a rapidly rotating grinding wheel and a slowly rotating regulating wheel upon a work rest or blade; one of the wheels being tilted to give the necessary feed to the work.

In internal centerless grinding machines it is not possible to pass the work through the machine but the rotating regulating wheel, together with rotatable work rest, or stationary blade, and pressure rolls, is used. The regulating roll rotates and governs the rate of rotation of the workpiece while the grinding wheel is removing material from the bore. In this case the regulating roll takes the place of the grinding wheel of the external machine while the pressure roll takes the place of the regulating wheel thereby providing the usual grinding throat.

Through the combined efforts of the engineers of the General Motors Corporation, Cincinnati Milling Machine & Cincinnati Grinders, Inc., and The Heald Machine Company, the Heald Internal Centerless Grinders have been developed. These grinders have been thoroughly tried out under production conditions in various plants throughout the country and have proven very satisfactory as regards to quality, quantity and efficiency of production.

The Heald Internal Centerless grinders are entirely automatic in operation and the size of the finished bore is held within very close tolerances by either the Size-Matic principle or the Gage-Matic principle. These machines can be made with both sizing principles embodied therein whereby either type can be used as conditions warrant and the change from one type to the other is made in a very simple manner.

In the chucking type of grinder the axis of rotation of the workpiece is fixed by the axis of rotation of the chuck, therefore the diameter of a bore ground in this manner is governed by the distance between the axis of the work and the grinding face of the wheel.

In the chuckless type of grinder, such as the internal centerless, the axis of rotation of a workpiece is not fixed but is governed by its outside diameter with the result of having the axis of rotation in different positions in successive workpieces having different outside diameters.

Concentricity of the bore and the ouside diameter of a workpiece in scores of instances is the essence of its usefulness and in an endeavor to obtain concentricity within extremely close tolerances it has been necessary to use elaborate and costly fixtures and close inspection on all operations.

With the chuckless type of grinder the arrangement of the work controlling elements is such that a uniform wall thickness is produced as it is governed by the distance between the grinding wheel and the regulating roll with the result that practically perfect concentricity between the bore and the outsde diameter is obtained; in fact, when a workpiece is placed on an arbor and swung between centers the indicated concentricity is within .0001".

There are two ways of locating the work in internal centerless grinding which consist of:

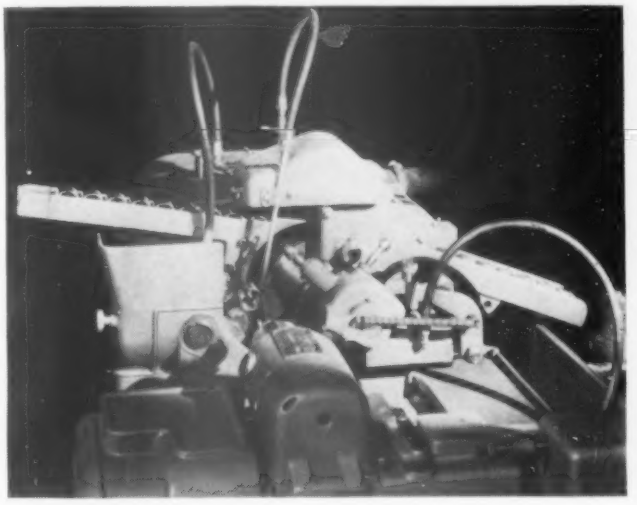
1. Locating and squaring up from the outside diameter.
2. Locating from the outside diameter and squaring up with the back face.

When locating and squaring up workpieces from the outside diameter the lands on the rolls are slightly less than the width of the workpiece but when squaring up with the back face the lands on the rolls are narrow so that they do not have any great tendency to square up the workpiece. In order to hold the workpiece against the backing plate the pressure and regulating rolls are skewed so as to force the workpiece in the direction of the backing plate.

In setting up a machine using plug gauges a finish ground workpiece is slipped over the gauges and the rolls are adjusted to contact with the outside diameter. In setting up a machine using the Size-Matic principle of size determination a special plug having a portion of its length ground to the same diameter as the outside diameter of the workpiece is used.

Should the working surface of the rolls become rough they must be reground and usually the regulating roll is ground in place using the same wheelhead as is used for the work. The rest and pressure rolls are removed as units and ground on their own bearings in a plain grinder.

The centerless loading cycle starts after the finished workpiece leaves the wheel and is controlled by a hydraulically actuated mechanism which is interlocked with the table movements in such a manner that it is impossible for the table to start toward the wheel until the cycle is complete. This is a very important safety feature as it prevents damage to the machine and possible injury to the operator in case a workpiece should become jammed so as to prevent the completion of the loading cycle before the table moves the workpiece to the wheel.



When a workpiece is finished the table runs out to loading position where the work is ejected from the machine and a new workpiece is positioned for grinding by the loading arm. The loading arm moves in a clockwise direction and discharges the finished workpiece over the regulating roll and at the same time a cam on the loading arm shaft actuates a work stop which allows an unfinished workpiece to leave the loading chute. The workpiece leaving the chute first rests on the back surface of the loading arm and as the arm moves in an anti-clockwise direction the workpiece finally drops onto the regulating roll and is lead into position on the rest roll.

As the loading arm starts in its clockwise movement a cam on the loading arm shaft causes the pressure roll to be moved away from the workpiece so that it can be ejected from the machine and a new one placed in position after which the pressure roll returns to its original position where it is held by adjustable spring pressure.

The speed of the regulating wheel is generally fixed and, as it drives the work by its outside diameter, different workpieces having the same general proportion between the bore and outside diameter will all run at approximately the same surface speed. If it should be necessary to change the speed of the regulating wheel for a workpiece having a large outside diame-

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ter and a small bore, it can be accomplished by changing pulleys.

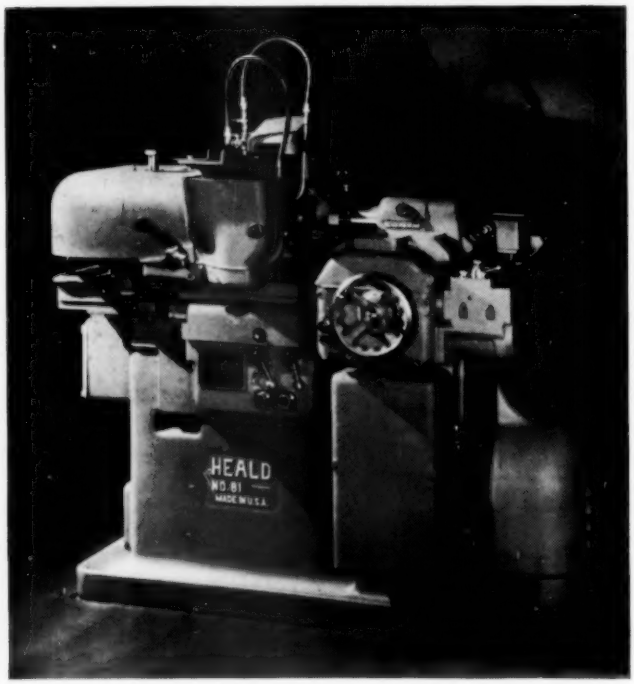
The work driving unit which provides the regulating wheel is a compact, self-contained unit, having an individual ¼ H.P. motor to drive the regulating wheel spindle, carried on a sub-base which is pivotally mounteted on the reciprocable table so that taper work can be ground. This work driving unit is transversely adjustable relative to the table movement in order that different lots of workpieces having different outside diameters can be ground. The spindle is mounted in preloaded ball bearings having automatic take-up for expansion and wear.

The supporting and pressure rolls are carried by a bracket bolted to the sub-base, the supporting roll being held stationary in adjusted position while the pressure roll is oscillatable.

The wheelhead is mounted on a bridge spanning the table ways which gives it a rigid support so that the high wheel speeds necessary for small holes are readily attainable. Straight, tapered, continuous, interrupted, open, or blind holes, in parts having finished cylindrical outer surfaces, can be readily ground. By having a fixed relation between the cross slide and the control box it is possible to use positive mechanical controls.

The cross slide, a large, rigidly supported member providing large bearing surfaces to minimize wear, is actuated by means of a screw having a spring take-up to eliminate backlash.

The cross feed mechanism is hydraulically actuated whereby a smooth, continuous feed is imparted to the grinding wheel at any rate suitable for the work being ground. An automatic re-



ducing valve maintains a constant low working pressure at the feed valves irrespective of the changes in the high pressure line. By having this mechanism independent of the table reciprocations the relative speed of the table and feed of the wheel can be readily obtained which assists materially in obtaining accuracy, finish and production.

Using a hydraulic medium for actuating the feed mechanism makes possible five separate feed adjustments although seven distinct functions are performed by the cross slide during each grinding cycle. These functions consist of a pick-up feed upon entry of the wheel into the work, reduction of feed to roughing feed, roughing feed to a semi-finish feed, stopping of feed movement to true the wheel, a further reduction of feed to practically nothing for a spark-out feed, and finally, upon the hole reaching the predetermined size, backing off the wheel and compensating for wear due to grinding and truing.

Where an extremely high finish is not necessary, the spark-out feed can be eliminated to speed up production without sacrificing the accuracy of the hole.

The cross feed screw is directly connected to the hand wheel for ease in setting up the machine by turning a serrated ring clockwise and rotating an eccentric which lifts the feed pawls from the ratchet. After the machine is set up the cross feed screw is automatically rotated by the hydraulic mechanism; the operator having first lowered the feed pawls into contact with the ratchet by turning the serrated ring anti-clockwise.

The cross feed mechanism consists essentially of an annular member secured to a pinion which is loosely mounted on the hand wheel shaft that carries the ratchet. The pinion is in mesh with a rack on the end of a piston rod extending from a horizontal cylinder. The feed pawls are pivotally mounted on studs provided by the annular member which also provides the feed rate control cams.

The right hand cam controls the fast pick- up feed by pushing a valve plunger to the right at which time the feed rate is slowed down to coarse feed, controlled by a throttle valve set by means of the left hand knurled knob.

The coarse feed continues until just prior to interrupting the grinding, for the purpose of truing the wheel, at which time the plunger is moved further to the right by the cam and the feed reduced to the rate controlled by a throttle valve set by right hand knurled knob. By introducing the fine feed, before interrupting the grinding, the spring in the spindle is relieved and a better truing of the wheel is procured.

On machines controlled by the Size-Matic principle, the interruption of the grinding for dressing is procured by means of the left hand cam also carried by the annular member. The first step on the cam rocks a lever which moves a rod and trips a latch, in the reverse box, that actuates a valve to slow down the rate of table travel to that permitted by a throttle valve set by a knob on the front of the reverse box and to stop the cross feed.

On machines controlled by the Gage-Matic principle the interruption for dressing is procured by means of a trip screw which is controlled by the entry of the roughing gauge into the work.

After the dressing stroke is completed the fine feed starts up again and continues until the valve plunger is moved farther to the right by the right hand cam to still further reduce the rate of feed for sparking out. The spark-out feed continues until the second step on the left hand cam, in the Size-Matic machines, or the runout trip screw in the Gage-Matic machines, trips a second latch in the reverse box to actuate a valve which reverses the direction of movement of the cross feed to back off the wheel from the work. The actuation of this valve also makes it possible for the reciprocating table to run out to loading position.

Compensation for the reduction in diameter of the wheel due to wear and truing is made when the wheel is backed off from the work. To accomplish this result the left hand feed pawl provides a pin which rides upon a cam and lifts the pawl out of contact with the ratchet whose rotation in a clockwise direction is continued by the right hand pawl until the table is run out to loading position.

When the direction of movement is changed the annular member rotates in an anti-clockwise direction but the feed screw does not move until the pin leaves the cam and allows the pawl to contact with the ratchet. This delay which, in reversing the movement of the feed screw, compensates for the wheel reduction is adjustable so as to get the proper amount of compensation; the adjustment being made by means of the knurled knob at the left of the hand wheel which moves the cam relative to the moment of backoff.

By using the improved Heald hydraulic mechanisms a fully automatic internal grinding machine that performs the complete cycle, loading the work-holding fixture, grinding the bore of a workpiece and discharging the finished workpiece, with positiveness and freedom of vibration which is so essential in order to obtain a high quality and quantity of production.

Fluid under pressure for the hydraulic system is provided by a rotary gear pump drawing oil from a 15 gallon oil tank which is an integral portion of the base. The table is reciprocated by a cylinder and piston unit in which the reversing valve has been incorporated.

The control box is a very compact unit mounted on the front of the base where it is readily accessible. Within the reverse box is contained the reverse lever and two trip latches, one of which allows the actuation of a valve to cause the truing device to be lowered into the path of the wheel and to slow down the rate of table travel so as to properly true the wheel.

At the same time a lever is raised into the path of the reverse dog which is lifted clear of the reverse lever so as to procure the extended stroke of the table necessary for the wheel truing operation. An adjustable dog is provided by the table which strikes the reverse lever directly after the truing device has

"See page 6 for important next meeting announcement."

passed the wheel and the table returns the work to the wheel for finish grinding.

The above valve is reset after truing so that the fluid under pressure is cut off from the truing device and opened to exhaust which allows the truing device to be positively returned to its normal position, away from the path of the wheel, by a cam on the bridge.

The wheel truing device, providing a diamond, is a rigidly constructed, self-contained unit which is bolted onto a carefully scraped pad on the main table. The diamond carrying arm is mounted on ball bearings so that it is oscillated smoothly and easily into and out of position. While this device normally works automatically it can be manually operated, when desired, for truing a new wheel.

A very important feature in the construction of the truing device is the ability to easily adjust the diamond point for height as well as relative radial movement. Each adjustment can be made independently without effect on the other.

The other latch is tripped when the work has reached final size and allows the resetting of the second valve and the raising of the lever into the path of the reversing dogs, working stroke dog and truing stroke dog, which are lifted clear of the reversing lever to allow the table to run out to loading position. The resetting of this valve allows the fluid to enter the cylinder unrestricted so that the table moves out to loading position at a fast rate of speed.

The table dogs are carefully covered by a swinging guard.

As the table moves to loading position the piston in the cylinder cuts off its exhaust port and forces the fluid through an auxiliary port which is connected to a vane type motor on the end of the loading arm shaft thus causing the loading arm to move in a clockwise direction to eject the finished workpiece. The table is reversed when the loading arm is at the top of its stroke and then the fluid under pressure from the pump flows directly to the vane motor and from there to the cylinder to cause the table to move the workpiece to the wheel, the loading arm having returned to its lower position with a new workpiece prior to the table picking up its working rate of travel.

The wheelhead used with this machine is known as the Heald Red Head which has special super-precision matched bearings and is ruggedly built for speed. This wheelhead stands up for long periods of time under the hardest production schedules. A single length of belt is suitable for practically all sizes of pulleys as the difference in required length is taken care of by automatic, ball bearing mounted take-up idlers in the base.

Automatic compensation is provided to take care of the reduction in wheel diameter due to wear and truing whereby the wheel is always maintained in correct relation to the finished size of the workpiece.

To prevent damage to the machine when the wheel reaches its smallest allowable diameter a limit switch, adjacent to the cross slide, stops the entire machine at this time. This patented function makes it possible for an operator to run a battery of machines without the necessity of watching the wheel wear.

The main drive for the machine is obtained from a 5 H.P. 1800 R.P.M. motor mounted on the rear of the base close to the floor to minimize any vibration. There are no gears or chains employed as all drives from the motor are by multiple Vee belts or flexible couplings.

The oil pump which supplies fluid under pressure to the hydraulic system is directly connected to the motor by a flexible coupling and the water pump, located on the far side of the oil pump, is also connected to the motor by a flexible coupling.

Oil for the hydraulic and lubricating system is kept clean by being passed through a filter to prevent dirt and grit from getting into the various valves and mechanisms.

Coolant is supplied from a 30 gallon tank placed at the end of the machine.

Force feed lubrication is used for the table ways and the flow of the oil is observed through a window in the base.

As previously noted the Heald No. 81 Centerless Internal Grinder is made with either Size-Matic or Gage-Matic control for size, or a combination of both types of control.

The Size-Matic control for size depends upon the relative positions of the diamond and regulating roll and the control cams directly associated with the cross feed screw. The result of this type of control is to grind successive workpieces to a uniform wall thickness regardless of the number handled at a time. In this case the finished size of the bore varies with the outside diameter of the work and the size variation equals the accuracy of automatic sizing plus the variation in outside diameter which is due to the fact that the wall thickness is a fixed dimension.

It has been found far more satisfactory to use the Size-Matic principle of size control for taper bores due to lack of substantial gauging points.

The Gage-Matic control for size depends upon plug gauges

which hold the bore to a definite size. With this manner of controlling size the wall thickness of successive workpieces will vary in proportion to the outside diameter and the closest size tolerance when grinding one piece at a time equals the maximum accuracy of the sizing device.

A machine having Gage-Matic control has the greatest accuracy when grinding workpieces one at a time but when grinding two or more pieces at a time the Size-Matic is preferable.

Since the outside diameter of a workpiece is used as the determinator for wall thickness it is obvious that the finished bore will follow any irregularity in the outer surfaces, therefore it is very important that the finish and roundness of the outside diameter of the workpiece be of high standard and close tolerance.

New Catalog

The Carboloy Company, 2481 East Grand Boulevard, Detroit, now has available their latest booklet "Carboloy Cost-Saving Tools."

Help Wanted

DESIGNING engineer wanted; requisite, college graduate, practical experience in design and manufacture of small tools, ability to direct technical division of small tool business, age 25 to 45. Give complete details of education and experience. Address A.S.T.E. Journal, 8203 Woodward Avenue, Box 248.

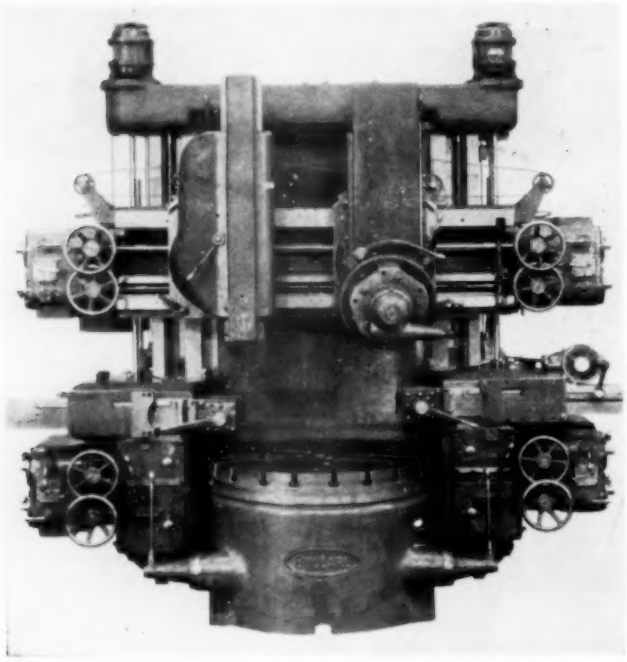
"See page 6 for important next meeting announcement."

Bullard Hydro-Shift Vertical Turret Lathe

MORE than ever during the past few years, the Machine Tool Industry has come to the front with the development of machines being characterized by Flexibility. These machines have been designed with the aid of customer requirements and suggestions. Such ideas when combined with years of experience in the construction and operation of manufacturing equipment, have enabled machine tool builders now to offer machines which meet the needs of today and the future—machines with a more modern degree of Efficiency and Economy.

Based upon over fifty years of study and experience in building machine tools, The Bullard Company now introduces their new machine—Hydro-Shift Vertical Turret Lathe in 56", 66", 76", and 86" sizes. The features of Bullard vertical construction have not only been maintained, but materially improved and added to, and the Complete Flexibility, Accessibility, and Ease of operation of these New Equipment Units more than ever bring out the possibilities of a new phase in cutting time between cuts.

Hydro-Shift, as the name implies, introduces in this type of machine a hydraulically operated speed shift mechanism with a visible indicator dial handily reached from the operator's station. In addition to this, anti-friction bearings are applied



throughout the machine except the table bearing, and many novel but practical features, both electrical and mechanical, have been incorporated. Engineering skill and ingenuity have been given free rein in an effort to make Hydro-Shift a Practical Premiere in Efficiency and Economy.

Castings, heavily ribbed internally to provide extreme rigidity, form the bed of the machines. Huskiness and sturdiness have been prime consideratons, and the cross-sectons of the base walls are of sufficient thickness to assure elimination of vibration and to give a rigid and firm support for Cross-Rail, Main Heads, and Side Heads. To further assure complete rigidity and firmness of the sliding members, wide bearing surfaces and heavy gibs have been provided. These sliding members, Cross-Rail, Main Head Saddles, Swivels, and Side Heads, are single-unit iron castings proportionately heavy and properly ribbed to obtain maximum strength, long life with maintained accuracy, and elimination of weave under heavy cutting.

Realizing the increased scope and added efficiency obtainable by the use of two Side Heads, this feature has been incorporated in the design of Hydro-Shift. To assure sturdiness and elimination of vibration and weave, these one-piece Side Heads are mounted directly upon the ways of the bed. The slides of each are forged bar steel rams provided with four face indexing turrets. In order to provide firm bearings for the slides, thereby eliminating weave, a sturdy brace plate bridges the width of the slide groove in the casting.

SHEFFIELD VISUAL GAGES

Designed to meet unusually high standards of accuracy and exceptionally close tolerances, Sheffield visual gages are being marketed by The Sheffield Machine & Tool Company, Dayton, Ohio. They are flexible to take care of slight changes in the design dimensions of the work, have a reasonable first cost and low maintenance expense.

These portable instruments carry a combination of a Reed mechanism and a lens whereby a magnification of 5000 to 1 is obtained, making .0001" read ½" long on the scale. As now designed, these gages make it possible to read .0001" as easily as it formerly was to read .001".

The Reed unit incorporated in these gages is a patented mechanism manufactured exclusively by the Sheffield Company which provides the basic principle for operating the gages. It derives its name from the four flat reeds used in its construction. The reeds are so arranged that when a part is inserted between the anvils, a compression stress is set up in one reed and a tension stress in another. Since one end of this system of reed and pointer is fastened to a fixed member, the movement resulting from the equalization of these stresses causes the pointer to take a new position which is indicated on the scale. Incidentally the Reed unit for machine control is not confined to gaging instruments, but is utilized on more than one hundred fifty machines.

The Sheffield visual gages can be plugged in at any 110 volt A. C. 60 cycle light socket. A transformer is mounted in the base of the gages for stepping down 110 volt A. C. to 8 volt A. C., which current is used only for lighting the 6-8 volt bulb.

This instrument is now being used in production rooms for checking piston pins, bearing rolls, connecting rods, refrigerator parts, mica, copper wire, and many other parts where interchangeability is required. In gage rooms it is employed for checking tools requiring exceptionally close tolerances. It is an instrument combining mechanical and optical amplification, enabling the user to maintain laboratory standards of accuracy on production work.

A patented design and construction provide a new simplicity in precision comparators, eliminating gearing, pivots, fulcrums, levers, knife edges, or any wearing parts.

J. F. Luby and J. L. Addy, long affiliated with the Machine Tool Industry in Detroit, have organized a new sales agency known as the Addy & Luby Machinery Co., located at 8316 Woodward Ave., Detroit. They will handle a general line of machine tools, and are at the present time Detroit representatives for the Foote-Burt Co's line of Standard Machinery; Fitchburg Engineering Corporation's line of Cylinder Borers, Horizontal Boring Machines, Milling Machines and Milling Units; and the Millholland line of Drilling and Tapping Units.

Mr. Frank Bender, formerly Assistant Plant and Tool Engineer, at the Copeland Products Corp., Mt. Clemens, Michigan, is now associated with the Chrysler Corporation, New Castle, Indiana, as Assistant Master Mechanic.

About March 1st, 1934, Vickers Incorporated will occupy their new plant located at 1400 Oakman Blvd., Detroit. Designed, built and equipped to suit their particular needs, it will greatly increase production capacity and also facilitate additional research on the application of hydraulic drives, feeds, and controls to a greater variety of equipment.

"See page 6 for important next meeting announcement."

A DESK TYPE OF PROFILE PROJECTOR

A new type of profile projecting equipment has recently been introduced in which the screen, a glass plate 12½" x 15¾", is set in the top of a steel cabinet inclined at a slight angle like a drawing table. The articles to be tested are placed on a smaller glass plate at the rear of the screen. This supporting table is 2⅜ inches in diameter and is set in a circular ring permitting rotation of the object and the ring is mounted in two cross slides that give movement in the two horizontal coordinates. The table can also be raised and lowered for focusing the projection on the screen, a coarse and a fine adjustment and a clamp being provided for this movement.

The condenser and lamp are mounted above the object table and the light is projected through an objective within the steel cabinet to an inclined mirror from which it is reflected perpendicularly to the upper surface of the glass screen inclined at 15° from the horizontal. Thus there are no shadows of the operator's head and hands or the implements he uses, to interfere with his work at the screen, and he can not only closely examine the projection but can make measurements of it with glass scales or a rectangular coordinate measuring device furnished as an accessory and fitted to the table top. If no drawings of the part are available it is a simple matter for him to copy the profile. Or photographic or Van Dyke paper, or a photographic plate in a suitable holder, can be laid on the screen and a copy can be made in this way to show the irregularities or relation of the projection to the tolerance drawing.

Four objectives can be had with the equipment which give magnifications of 10, 20, 50 and 100 diameters respectively. These magnifications are guaranteed accurate to 1 part in 2000, so that standard glass scales graduated to fiftieths or hundredths of an inch can be used to measure the errors in an integral ratio of the magnification to the original. Thus 0.01" measured on the projection with the 100-power objective corresponds to 0.0001" on the article being tested, or to 0.0002" if the 50x objective is used, or to 0.0005" with the 20x objective, or to 0.001" with the 10x objective. The size of the object which can be enlarged to the full size of the screen with the different objectives ranges from ⅛"x5/32" to 1¼"x 1 9/16".

Changes of magnification can be made in just a few seconds, by merely sliding one objective in place of another.

The accessories of the apparatus include several supports for various types of pieces; for example, a plain center support of 2 5/16" diameter capacity, an inclinable center support for screws and milling cutters, a support with one center for small milling cutters, an inclinable V-shaped support for screws and parts without centers, and another support for small pinions of watches. Design of special fixtures will also be studied upon request.

Profile gages can also be checked easily for outline or width of gap. It is also an easy matter to measure the average dimensions of any sort of particles scattered on the object table, such as sand grains, particles of abrasives, material ground to different grades of fineness, textile and paper fibres and "flocks" used in making suede cloth, or even the dimensions of microscopic animal or vegetable material.

Threaded pieces of all kinds, such as bolts, screws and taps, can be examined as to the accuracy of the profile of their threads or their pitch. The accuracy of profile cutters and milling cutters and other cutting tools can be checked by comparisons with the theoretical profile. Pinions, small gears, ratchet wheels and parts of arms, munitions, office machines, time fuses, watches, clocks, and meters are only a few of the metal pieces that can be examined rapidly and with precision.

The overal dimensions of the apparatus are 3'9" x 4' x 6'2". Its net weight is 414 lbs. The apparatus is manufactured by the Société Genevoise d'Instruments de Physique of Geneva, Switzerland, and is marketed in America by The R. Y. Ferner Co., 1008 15th St., N. W. Washington, D. C.

EXECUTIVES WANTED

THE remarkable growth of the American Society of Tool Engineers during its short history is the topic of animated conversation wherever its record is known. Its growth surprised many who voiced their doubts as to the advisability of starting a society, or anything else, in the midst of a world-wide economic debacle. Naturally, it was not these fearful ones who started the Society, nor is it ever the faint-hearted who start anything except retreat and failure.

The three factors contributing most to the Society's success to date are: First—The need for such an association of production toolers, Second—Courageous leadership and, Third—The factor which seemed to many an insurmountable obstacle to its successful inauguration, namely,—a most hated word in any language, the depression.

The slowing-up of production tooling activity three years ago gave tool engineers a much needed opportunity to take stock of the obstacles confronting them in meeting the demands made upon them for more efficient and speedier tooling-up for the manufacturing of constantly changing products.

It is doubtful whether anyone could be found who questions the absolute necessity of the free exchange of ideas, the dissemination of information pertinent to tooling, and the good-fellowship resulting from the Society's activities to date. Everyone freely admits the need for the Society's existence and its development into a more efficient instrument of education. We must all admit that mistakes have been made and that our ideals have been attained only in a small measure. Each recognizes the fact that much yet remains to be accomplished.

The ones who started the Association were not afraid to give free reign to their imaginations in the first gatherings held for the purpose of discussing the possible benefits of such an Association. It takes courage for anyone to lay himself open to possible criticism by his fellow workers by voicing such ideals. Most practical tool engineers don't like to be dubbed "Dreamers." It is so essential that their ideas be practical and absolutely workable. However, once the ideal dreams of the first speaker at the first little meeting were exposed it was discovered that everyone in the group was in complete harmony and immediately set himself to the task of perfecting plans to make the dream a reality. These men who met at these first little gatherings were the far-sighted fathers of the American Society of Tool Engineers. They saw what the Society could accomplish and at that date had sufficient time to devote their services whole-heartedly and unreservedly as its first officers.

There are more today who believe in the Society and who can see what it has accomplished and vision greater accomplishments for the future. There is, however, today a greater obstacle to the Society's march to a finer service than has ever existed before. This obstacle is the return of something approximating normal manufacturing activity. While the desire for a bigger and better Society is stronger today than ever before, the Society members find themselves so engulfed in the renewed activities incident to the discharging of their duties on the job that they feel they cannot devote sufficient time to Society activities. The natural consequence is the over-burdening of the present officers and certain members of committees tending to slow-up normal activities of the Society.

The time has come for the present tired-out officers and committee members to relinquish their duties to new leaders. The new nominating committee reports that certain capable prospective nominees have refused to be considered as such, giving as a reason that their over-time work makes it impossible for them to render the service they feel the Society is entitled to from its officers. It seems the NRA did not consider this phase of executive activity when outlining its recovery program.

The world needs leaders. America found hers. May the nominating committee find those who realize that in serving others they serve themselves best.

"See page 6 for important next meeting announcement."

A MODERN MACHINING TOOL-UP

PISTON machining operations in one of the most prominent automobile shops in Detroit were a source of continual trouble. This was due almost entirely to the fact that proper attention to selection of equipment had been neglected year after year. The general attitude towards the job was that it was a light aluminum part, easily machined, and not worthy of any considerable expenditure for tools. Snaky ring grooves were the only thing to which attention was given. The connecting rod straightening operation after the piston was assembled to the rod took care of any mis-alignment in the piston itself.

Suddenly someone decided that it was bad business to kink a connecting rod because it didn't "stay put" in the motor. Diamond boring machines appeared in many plants in the rod line and straigntening was forbidden. Then the fun began with the piston. It had to be a real job to withstand inspection in assembly with a perfectly aligned rod. After a couple of years of adding corrective operations which did not reduce the cost of the part a particle, and, incidentally, being responsible for a couple of foremen losing their "heads" over quality, the tool divisions awoke to the fact that their tools were obsolete.

In a certain plant it was pointed out that one of their competitors had a much better lineup. This tool-up was duly inspected, criticised and praised, and finally it was decided that it would pay to spend a respectable amount of money for some of the equipment that the poor, starving machinery salesmen had been humbly proffering them with no results for two or three years. The time study department co-operated and estimated a startling saving.

The lineup which was finally conceived and installed, together with the pre-determined cost which has been confirmed by results, follows:

Oper. 10—Bore and face and center skirt end and center head end
No. 4 W&S Screw Machine
Air Chuck
Double end Centering Equipment
Power feed

Oper. 20—Recenter skirt end
Special self-centering bench tool

Oper. 30—Rough and finish cam turn O.D.—rough and fin. face head end (leaving center boss)—Turn lands and grooves complete
(2) Fay Automatic Lathes

Oper. 40—Drill (8) Angular 5/32 holes in wrist pin bosses
Avey Drill Press—2-station index fixture
2-Spindle Head
Hand feed

Oper. 50—Rough bore wrist pin hole
121 Baker Drill Press
2-Spindle Head—(high speed)
Double fixture—2 pieces per pass

Oper. 60—Drill oil return holes and saw slot end holes
Spec. Kreuger Drilling Machine

Oper. 70—Blow out chips
(Bench Operation)

Oper. 80—Saw horiz. and vert. slots
Whitney Hand Mill
Double Fixture—2 positions
(Saws 1 slot in each position per pass)

Oper. 90—Machine wrist pin lock grooves and chamfer wrist pin hole
Special Bench Spindle
(Cam expanding cutters)
Hand feed—2 passes required

Oper. 100—Finish Cam Grind O.D.
Landis External Grinder

Oper. 110—Rough and finish bore wrist pin hole
(2) Excello 2-way Precision Boring Machines
3 pieces per pass

Oper. 120—Spotface center boss flush with finished head end
Avey 1-spindle Drill Press
Piloted End Cutter
Air operated fixture
Hand feed

Oper. 130—Wash and blow off chips
Tank—Lattice Basket—Air Hose

Oper. 140—Weigh and mill to standard weight
Morris Special Weighing and Milling Machine
Equipped with scales accurate to 1 gram

Oper. 150—Roll trade mark on head end

TIME STUDY'S PRE-DETERMINED COST

(For method see article in January issue)

Oper.	Net Prod.	Hr.
1	222 per hr.	.00445
2	550 per hr.	.00182
3	160 per hr.	.00625
4	290 per hr.	Done on Oper. No. 50
5	150 per hr.	.0067
6	400 per hr.	.0025
7	800 per hr.	.00125
8	303 per hr.	.0033
9	250 per hr.	.004
10	80 per hr.	.0125
11	450 per hr.	.0067
	Note:—Operator runs (2) Excellos	
12	250 per hr.	.004
13	550 per hr.	.00182
14	150 per hr.	.0067
15	454 per hr.	.0022
Time allowed for job setter		.006
Time allowed for incentive 10%		.007
Total Standard Time		.0772

Hardly more than half the space was required for this layout and the quality of the product was superb. It is a shining example of the savings which result from thoughtful tool engineering and time study on small parts which often are passed up.

A savings of $.16 per motor was effected.

"See page 6 for important next meeting announcement."

"See page 6 for important next meeting announcement."

MICHIGAN TOOL COMPANY'S INVOLUTE CHECKING MACHINE

The need of a Universal Involute Checking device of an improved type, has been realized in this most recent Michigan Tool Company development.

No master forms are required. No master base circle discs are required. Readings are made more rapidly than by any other method. Charting for comparison with other checking devices is readily accomplished.

This machine employs a sine bar similar to those in use on other Michigan Tool Company equipment. The function of the sine bar in this case, is to act as a compensator for the difference between the length of arc of 1° on the friction disc that originates all the machine movements, and the length of arc of 1° on the base circle of the gear being checked. These various parts are shown on the photo attached.

The friction disc which is integral with the work holding spindle, imparts movement to the sine bar carriage. Each degree of rotation of work is shown on a scale alongside the sine bar carriage. The angular settings of sine bar controls the movement of the indicator head, which is mounted on balls in "V" grooves and counterweighted to hold it against the sine bar. The indicator head moves at right angles to the movement of sine bar carriage so that the smaller the gear being checked, in comparison to the friction disc, the smaller the angular setting required on sine bar.

By use of two indicators and a reversible indicator finger, both sides of a gear tooth may be checked without dismounting, turning gear upside down, or otherwies changing the set-up. This feature makes more consistent checking possible.

The construction of this machine assures a very lasting accuracy.

The principle is theoretically correct.

The checking is performed rapidly.

The capacity, 12" diameter by 12" in length, is ample for most work.

TECHNICAL

STRENGTH OF MATERIALS

Torsion in Shafts

by W. J. McKEEN

(Continued from last issue)

In the February issue of the Journal a formula was given for the diameter of shafts taking into consideration bending and twisting forces.

The example considered was a shaft protruding from a bearing with a pulley on the end of the shaft, the twisting force acting at a tangent to the periphery of the pulley.

In this article the case will be considered of a shaft acted on by a twisting force between supporting bearings.

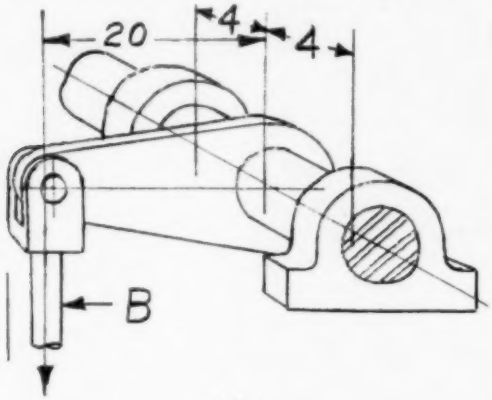


Fig. 1

Fig. 1 is a steel shaft supported by the two bearings. In the center of the two bearings is a 20 inch lever on the shaft. The pull on the shaft B is 1000 pounds. The factor of safety is 20. What should be the diameter of the shaft?

The proceedure is similar to that given in the preceding article except for the conditions governing the bending moment M.

M must be found in order to obtain the equivalent twisting moment.

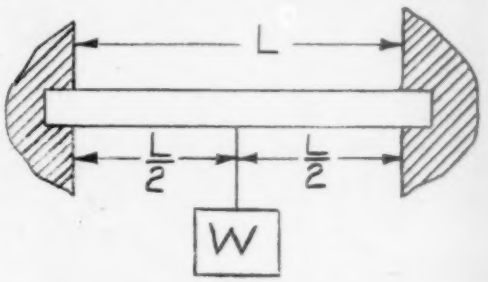


Fig. 2

Looking in the table of bending moments, for a similar case, we find it as shown in Fig. 2.

The bending moment is,

$$M = \frac{WL}{8} = \frac{1000 \times 8}{8} = 1000 \text{ inch-pounds.}$$

The twisting moment is $T = 1000 \times 20 = 20{,}000$ inch-pounds.

The equivalent twisting moment is,

$$T^1 = M + \sqrt{M^2 + T^2} = 1000 + \sqrt{1{,}000{,}000 + 400{,}000{,}000}$$
$$= 21025 \text{ inch-pounds, nearly.}$$

Using the formula given in the last issue,

$$\text{Diameter of Shaft} = \sqrt[3]{\frac{16T^1 f}{\sqrt{3.1416 S_s}}} = \sqrt[3]{\frac{16 \times 21025 \times 20}{\sqrt{3.1416 \times 70{,}000}}}$$

This case, and that in the last issue, are the two most common cases of torsion in shafts.

The pull on the rod B in this case corresponds to belt pull on a pulley or the thrust on a gear tooth.

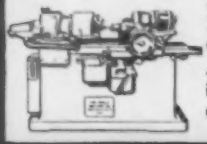
The five epochs of Internal Grinding

1861 . . . . . Ambrose Webster's, the First Grinding Machine

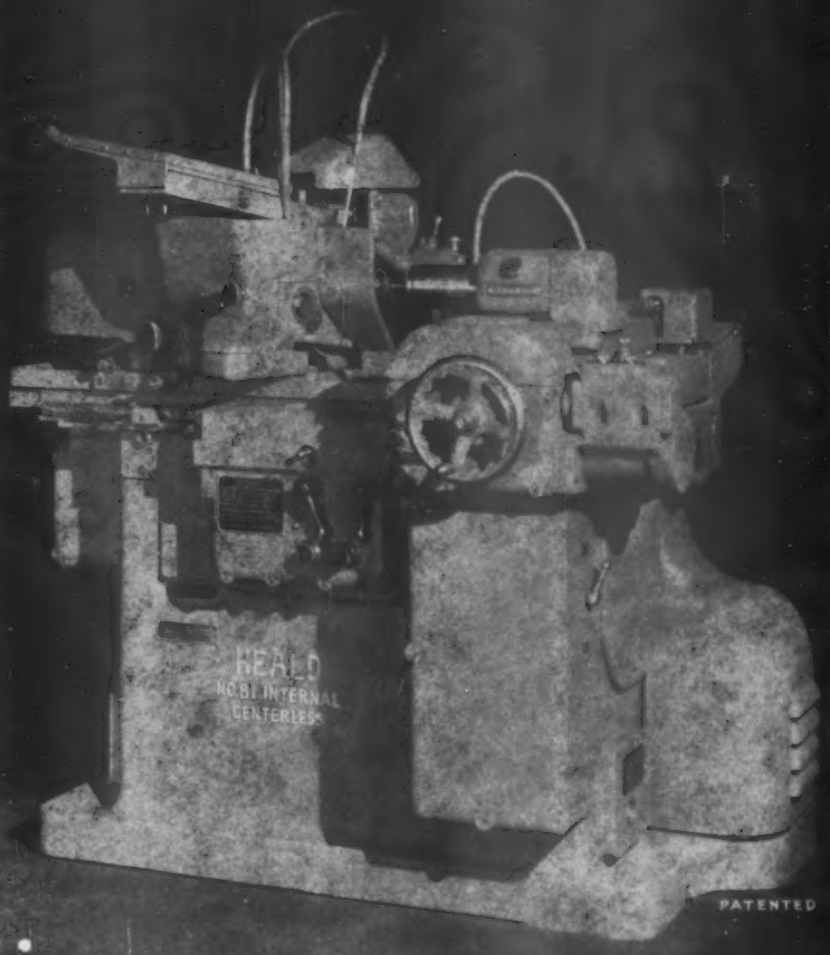
1880 . . Brown & Sharpe Universal, the First Machine used for Internal Grinding

1908 . . Heald Style No. 70 First Production Internal Grinding Machine

1924 . . . . Heald Style No. 72 Internal with an Automatic Size Control



and Now 1934



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ANOTHER epoch in the machine tool industry has been reached • *Internal Centerless Grinding* • A method of chuckless holding, long desired and now available • It makes possible simplified automatic loading and setup • Assures perfect concentricity of the bore to the outside diameter • Gives perfect wheel action • Makes rechucking readily possible for additional operations • Handles straight and taper work • Automatically sizes by either the Gage-Matic or Size-Matic principle • Heald perfected hydraulic controls throughout.

Complete information on request.

THE HEALD MACHINE COMPANY, Worcester, Massachusetts, U. S. A.

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